

CLAIMS

- 1 1. A composition comprising
- 2 a carrier liquid;
- 3 a dispersant ; and
- 4 a chemical hydride..
- 1 2. The composition of claim 1 in which the chemical hydride
- 2 has a concentration of at least 40% by weight of the composition.
- 1 3. The composition of claim 1 in which the chemical hydride
- 2 has a concentration of less than 75% by weight of the composition.
- 1 4. The composition of claim 1 in which the chemical hydride
- 2 has a concentration of about 61% by weight of the composition.
- 1 5. The composition of claim 1 in which the chemical hydride
- 2 has a concentration of more than 90% by weight of the
- 3 composition.
- 1 5. The composition of claim 1 in which the carrier liquid
- 2 comprises an organic liquid.
- 1 6. The composition of claim 5 in which the organic liquid
- 2 comprises mineral oil.
- 1 7. The composition of claim 6 in which the organic liquid
- 2 comprises a light mineral oil.

- 1 8. The composition of claim 1 in which the carrier liquid
2 comprises a hydrocarbon.
- 1 9. The composition of claim 8 in which the hydrocarbon
2 comprises an alkane.
- 1 10. The composition of claim 9 in which the alkane is selected
2 from a group consisting of pentane and hexane.
- 1 11. The composition of claim 1 in the form of a slurry.
- 1 12. The composition of claim 1 in which the carrier liquid has a
2 viscosity in the range of about 32 Saybolt Universal seconds
3 (S.U.s.) at standard temperature and pressure (STP) to about 100
4 S.U.s, preferably about 42 S.U.s. to about 59 S.U.s.
- 1 13. The composition of claim 1 in which accordance with the
2 carrier liquid exhibits a flash point in the range of about 100 °C to
3 about 350 °C, preferably about 154°C to about 177°C.
- 1 14. The composition of claim 1 in which the chemical hydride
2 comprises a light metal hydride.
- 1 15. The composition of claim 1 in which the light metal
2 hydride is selected from the group consisting of lithium hydride,
3 lithium borohydride, lithium aluminum hydride, sodium hydride,
4 sodium borohydride, sodium aluminum hydride, magnesium
5 hydride, and calcium hydride.
- 1 16. The composition of claim 1 in which the dispersant
2 comprises a triglyceride.

- 1 17. The composition of claim 16 in which the triglyceride acts
2 as a dispersant.
- 1 18. The composition of claim 1 in which the triglyceride
2 comprises a triglyceride of oleic acid.
- 1 19. The composition of claim 1 in which chemical hydride
2 comprises lithium hydride.
- 1 20. The composition of claim 1 in which chemical hydride
2 comprises magnesium hydride.
- 1 21. A method comprising the mixing of the chemical hydride
2 with a mixture of the carrier liquid and a triglyceride after which
3 the resulting mixture is further ground to form a stable slurry.
- 1 22. A composition comprising
2 a mass of chemical hydride particles in a concentration of about
3 90-95% by weight of the composition, and
4 oil coating the chemical hydride particles, the oil comprising 5-
5 10% by weight of the composition.
- 1 23. Apparatus comprising:
2 a reservoir containing a chemical hydride, and
3 a mechanism configured to introduce a reactant to selected
4 different portions of the chemical hydride to effect hydrogen
5 generating reactions at different locations within the reservoir.
- 1 24. The apparatus of claim 23 in which the reservoir comprises
2 a canister.

- 1 25. The apparatus of claim 23 in which the reservoir includes
2 chambers that contain chemical hydride.
- 1 26. The apparatus of claim 23 in which the mechanism
2 comprises conduits that have open delivery ends arranged to
3 introduce the reactant to respective selected portions of the
4 chemical hydride.
- 1 27. The apparatus of claim 23 in which the conduits are
2 arranged in parallel.
- 1 28. The apparatus of claim 27 in which the conduits are located
2 at different distances along an axis of the reservoir.
- 1 29. The apparatus of claim 23 in which the mechanism is
2 configured to be movable relative to the chemical hydride
3 contained in the reservoir.
- 1 30. The apparatus of claim 16 in which the conduits comprise
2 needles.
- 1 31. The apparatus of claim 23 in which the mechanism
2 includes a valving system that controls the introduction of the
3 reactant to the different portions.
- 1 32. The apparatus of claim 23 in which the reservoir includes
2 an exit for hydrogen generated in the reaction.
- 1 33. The apparatus of claim 23 in which the chemical hydride is
2 dispersed in a carrier liquid at a concentration of about 40-75% by
3 weight of the composition.

- 1 34. The apparatus of claim 23 in which the carrier liquid
2 comprises an organic liquid.
- 1 35. The apparatus of claim 23 in which the chemical hydride
2 comprises a light metal hydride.
- 1 36. The apparatus of claim 35 in which the light metal hydride
2 is selected from the group consisting of lithium hydride, lithium
3 borohydride, lithium aluminum hydride, sodium hydride, sodium
4 borohydride, sodium aluminum hydride, magnesium hydride, and
5 calcium hydride.
- 1 37. The apparatus of claim 33 also including a triglyceride
2 acting as a dispersant.
- 1 38. The apparatus of claim 23 in which chemical hydride
2 comprises lithium hydride.
- 1 39. The apparatus of claim 23 in which chemical hydride
2 comprises magnesium hydride.
- 1 40. The apparatus of claim 23 in which the reactant comprises
2 water.
- 1 41. A hydrogen fuel generation assembly comprising:
2 a reservoir for a slurry comprising a carrier liquid, a triglyceride
3 dispersant, and a chemical hydride;
4 a reservoir for water;
5 a hydride reactor in communication with said slurry reservoir and
6 said water reservoir and adapted to receive the slurry and water

7 from the reservoirs, respectively, and to mix the slurry and water to
8 effect release of hydrogen from the slurry;

9 a tank for receiving the hydrogen from said reactor and for
10 receiving hydroxide byproduct from said reactor, and for
11 facilitating separation of the hydrogen and the hydroxide
12 byproduct;

13 a heat exchanger for receiving the hydrogen from said tank and
14 adapted to condense water from the hydrogen;

15 a gas-liquid separator for receiving hydrogen and water from said
16 heat exchanger and adapted to separate the water from the
17 hydrogen and to dispense dried hydrogen;

18 a conduit for conveying the water from said separator to said water
19 reservoir; and

20 a conduit for conveying the dried hydrogen to a hydrogen-fueled
21 power-producing device.

1 42. The assembly of claim 41 wherein said reactor comprises a
2 tubular housing and a mixer for mixing the slurry and the water.

1 43. The assembly of claim 41 wherein said tank is provided
2 with an outlet for flowing hydrogen gas from the tank, and a
3 bottom portion for the receiving of the hydroxide byproduct.

1 44. The assembly of claim 41 further comprising the power-
2 producing device.

1 45. The assembly of claim 44 wherein said power-producing
2 device comprises a selected one of a fuel cell, an internal
3 combustion engine, and an external combustion engine.

1 46. The assembly of claim 45 wherein said power producing
2 device comprises a fuel cell, and further comprising conduit means
3 for conveying condensed water from said fuel cell to said water
4 reservoir.

1 47. The assembly of claim 45 wherein said power-producing
2 device comprises a selected one of the internal combustion engine
3 and the external combustion engine and the assembly further
4 comprises a condenser for condensing water from water vapor
5 from said engine, said condenser being in communication with
6 means for conveying water from said condenser to said water
7 reservoir.

1 48. A method for generating hydrogen fuel for a power-
2 producing hydrogen-fueled device, the method comprising the
3 steps of:

4 providing a slurry comprising an organic carrier liquid, a
5 triglyceride dispersant, and a chemical hydride;

6 mixing said slurry with water to effect release of hydrogen from
7 the slurry;

8 removing water vapor from the hydrogen released from the slurry,
9 to provide dried hydrogen; and

10 conveying the dried hydrogen to the hydrogen-fueled device for
11 the production of power.

1 49. The method of claim 48 wherein said organic carrier liquid
2 comprises a light mineral oil.

1 50. The method of claim 48 wherein said chemical hydride
2 comprises a selected one of lithium hydride, lithium borohydride, a
3 combination of lithium hydride and lithium borohydride, lithium
4 aluminum hydride, sodium hydride, sodium borohydride, sodium
5 aluminum hydride, magnesium hydride, and calcium hydride.

1 51. The method of claim 48 wherein said chemical hydride
2 comprises lithium hydride.

1 52. The method of claim 48 wherein said mixing of said slurry
2 and said water is undertaken with an auger.

1 53. The method of claim 48 wherein said mixing of said slurry
2 and said water is undertaken with an ultrasonic mixer.

1 54. The method of claim 48 comprising the further step of
2 flowing the water removed from the hydrogen back to a source of
3 the water for mixing with the slurry.

1 55. The method of claim 48 wherein the hydrogen-fueled
2 device comprises a fuel cell, the method comprising the further
3 step of flowing water condensed from the fuel cell back to a source
4 of the water for mixing with the slurry.

1 56. A regeneration assembly for converting metal oxides and
2 hydroxides to elemental metals, the assembly comprising:
3 a reactor adapted to receive the metal hydroxide and carbon, and
4 adapted to retain a molten carbon-dissolving metal in the reactor;

5 means for flowing gases comprising the elemental metal in
6 gaseous form, carbon monoxide, and hydrogen from said reactor;
7 a condenser adapted to receive the gases flowed from said reactor
8 and adapted to discharge carbon monoxide and hydrogen from a
9 first outlet and the elemental metal, metal oxide, and carbon from a
10 second outlet;
11 a separator adapted to receive the elemental metal, oxide thereof,
12 and carbon from said condenser and to discharge the elemental
13 metal in gaseous form;
14 means for flowing the elemental metal and the carbon dissolving
15 metal in liquid form from said reactor to said separator; and
16 means for flowing the metal oxide and the carbon dissolving metal
17 from said separator to said reactor.

1 57. The assembly of claim 56 further comprising a second
2 separator for receiving the carbon monoxide and hydrogen from
3 said condenser, said second separator having a first outlet for
4 discharging carbon monoxide and a second outlet for discharging
5 hydrogen.

1 58. A method for converting metal oxides and metal
2 hydroxides to elemental metals thereof, the method comprising the
3 steps of:
4 admitting the metal hydroxide and carbon into a reactor having
5 molten carbon-dissolving metal therein;

6 flowing gases comprising the elemental metal in gaseous form,
7 carbon monoxide and hydrogen from the reactor to a condenser;
8 condensing out the elemental metal and oxide thereof, and carbon,
9 and flowing same to a separator;
10 flowing carbon monoxide and hydrogen from the condenser;
11 flowing the elemental metal and the carbon dissolving metal from
12 the reactor to the separator;
13 flowing elemental metal oxide and the carbon dissolving metal
14 from the separator to the reactor; and
15 flowing the elemental metal from the separator.

1 59. The method of claim 58 including the further step of
2 flowing an inert gas into the reactor.

1 60. A composition comprising
2 a carrier liquid;
3 a triglyceride; and
4 a chemical hydride dispersed in the carrier liquid at a concentration
5 of about 40-75% by weight of the composition.

1 61. The composition of claim 1 in which the triglyceride
2 comprises triolein.

1 62 The apparatus of claim 23 in which the chemical hydride is
2 dispersed in a carrier liquid at a concentration about 90-95% by
3 weight of the composition.

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